Journal of Bodywork & Movement Therapies (2016) 20, 334–340

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/jbmt

ORIGINAL RESEARCH

The effect of adding whole body vibration training to strengthening training in the treatment of knee osteoarthritis: A randomized clinical trial

Hamid Reza Bokaeian, MSc [a], Amir Hoshang Bakhtiary, PhD [a,*], Majid Mirmohammadkhani, PhD [b], Jamile Moghimi, MD [c]

[a] *Neuromuscular Rehabilitation Research Centre, Semnan University of Medical Sciences, Semnan, Iran*
[b] *Center for Social Determinants of Health, School of Medicine, Semnan University of Medical Sciences, Semnan, Iran*
[c] *Internal Medicine Group, School of Medicine, Semnan University of Medical Sciences, Semnan, Iran*

Received 23 March 2015; received in revised form 11 August 2015; accepted 16 August 2015

KEYWORDS
WBV training;
Strengthening exercises;
Knee osteoarthritis;
Muscle performance;
Functional activity

TRIAL REGISTRATION
IRCT20120606651-52N2

Summary Strengthening training (ST) and whole body vibration training (WBV) alone may improve symptoms of osteoarthritis of the knee. In this study, we investigated the effect of adding WBV training to quadriceps and hamstring muscles strengthening training on functional activity, pain, quality of life and muscle strength in patients with knee osteoarthritis. 28 volunteers were randomly allocated to two groups; 1) quadriceps and hamstring muscles strengthening training (ST group, 13 patients) and 2) quadriceps and hamstring muscles strengthening training along with WBV training (ST + WBV group, 15 patients). The treatment protocol for both groups involved 3 sessions per week for 8 weeks. All measurements were performed before and after intervention. The measurements included: pain by means of a visual analogue scale (VAS), quality of life by means of the WOMAC scale, functional activity by the 2 min walking test (2MWT), time up & go test (TUGT) and 50-foot walking test (50FWT) and the muscle peak torque (MPT), total work (TW) and muscle power (MP) as muscle performance of quadriceps and hamstring muscles by an Isokinetic Biodex machine. After intervention, the comparison of mean changes between two groups showed improvement in the WBV + ST group

* Corresponding author.
E-mail addresses: hamid_boka67@yahoo.com (H.R. Bokaeian), amirbakhtiary@semums.ac.ir (A.H. Bakhtiary), majidmirmohammadkhani@yahoo.com (M. Mirmohammadkhani), Jamile_moghimi@yahoo.com (J. Moghimi).

http://dx.doi.org/10.1016/j.jbmt.2015.08.005

in terms of 2MWT, MPT, TW and MP variables ($P < 0.05$). However, no significant difference was found between the experimental groups in term of pain, quality of life, TUGT and 50FWT. These results suggest that adding whole body vibration training to strengthening training may provide better treatment effects for patients with knee osteoarthritis.

Introduction

Osteoarthritis (OA) is the most common Non-inflammatory degenerative joint disease with an incidence of 60–90 percent in elderly people over 65 years old (Das and Farooqi, 2008). The main symptom of knee OA is pain which is usually caused by weight bearing. Other features of knee OA include apparent osteophytes, difficulty of motion, varus and valgus deformities, joint instability, radiological signs and joint calcification (Altman et al., 1986). Although, there is no curative treatment for knee OA, generally three categories of palliative treatment have been recommended including; surgical treatment, pharmaceutical treatment and non-pharmacologic conservative treatment, such as exercise therapy (Fauci et al., 2008) and whole body vibration (WBV) (Stein et al., 2010).

It has been claimed that strengthening exercises may provide several beneficial effects for people with OA, including; facilitate analgesic endogenous opioids that cause the patient to be more tolerant (Fraioli et al., 1980), reduction in the degree of disability (Minor and Lane, 1996), considerable reduction in weight (Jenkinson et al., 2009) and other mechanical changes in the biomechanics of knee (Thorstensson et al., 2007). In addition, strengthening exercises may cause physical and mental effects that directly affect knee joint (Pearle et al., 2005). Because the excessive and unnatural forces may damage articular cartilage, it is assumed that the beneficial effects of muscle strength in patients with knee OA, may be due to the increased joint stability and reduced joint stress (McQuade and de Oliveira, 2011).

The other way of strengthening muscle force is WBV, which has been widely used recently to improve muscles performance (Stein et al., 2010). Several studies have confirmed that WBV training reduces age-related muscle atrophy and is an effective intervention in improving the functional capacity (Roelants et al., 2004) and metabolism (Rehn et al., 2007). Thus, the effects of WBV training and regular strengthening exercises is similar, except that the joint force is smaller In WBV training (Trans et al., 2009). However, recent research has shown significant improvements of symptoms in patients with osteoarthritis of the knee by this technique (Trans et al., 2009).

While, it has been stated that each of these interventions have beneficial effect for patients with knee OA, there is no study to investigate the beneficiary effects of combinations of these interventions. This study was designed to investigate the effects of adding WBV training to muscle strength exercises of the knee in patients with knee OA.

Method

28 of 58 patients with knee OA, who had been referred by a rheumatologist to Neuromuscular Rehabilitation Research Center, participated in the study according to the inclusion and exclusion criteria. The participants (2 males and 26 females) were randomly allocated into strengthening training (ST) (male = 31%, female = 69%) or strengthening training with WBV training (ST + WBV) (male = 0%, female = 100%) groups, using closed envelopes. Table 1 shows the demographic and the base line data of both experimental groups.

Inclusion criteria included having mild to moderate chronic osteoarthritis of unilaterally or bilaterally tibiofemoral joint according to the method of Kellgren & Lawrance, 35–76 years old, a history of symptoms more than a month and being able to walk with or without assistant devices (Hubley-Kozey et al., 2006). Reporting other diseases such as: diabetes, diseases of musculoskeletal, neuromuscular, cardiovascular, respiratory, etc., the use of injections or other invasive treatments (such as surgery) in the lower extremities during the last three months, having an artificial hip or knee joints, medication, history of trauma to knee joint during last week, performing regular professional exercise and extreme physical weakness were considered as exclusion criteria (Hubley-Kozey et al., 2006). The procedure of study is shown in Figure 1.

After signing the consent form both groups received an educational leaflet (Fransen, 2004), continues ultrasound therapy, hot pack, TENS (Cameron, 2003) and strengthening exercises protocol (Petersen et al., 2011). The treatment was done in each group by a separate physical therapist. Strengthening training protocol was performed 3 times a week for 8 weeks and included flexion and extension exercise of knee joint with the quadriceps chair. Before starting exercise training, all subjects were asked to perform warm up exercise on an ergonomic bicycle for 5 min. Each exercise session included 3 set with 2 min interval and the load of exercise was progressively increased from the 60–65% of 10 RM in the first set, 70–75% of 10 RM in the second set and 80–85% of 10 RM in the third set. The amount of 10 RM was measured every week for each participant. If the subject reported pain during exercise (VAS> 5), the range of motion was reduced. If the pain remained, the load was reduced (Petersen et al., 2011).

WBV training was applied after strengthening exercises in SE + WBV group, using Fitvibe device (Italy) with 2 mm vertical vibration intensity in a static situation. The patient was asked to stand on the vibration platform with bare feet and bent knees so that no fatigue or pain was sensed